AIRS-RTA Status, Evaluation, and Interaction with Community Model

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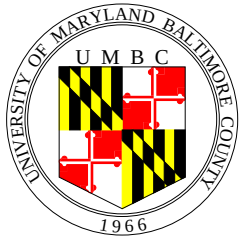

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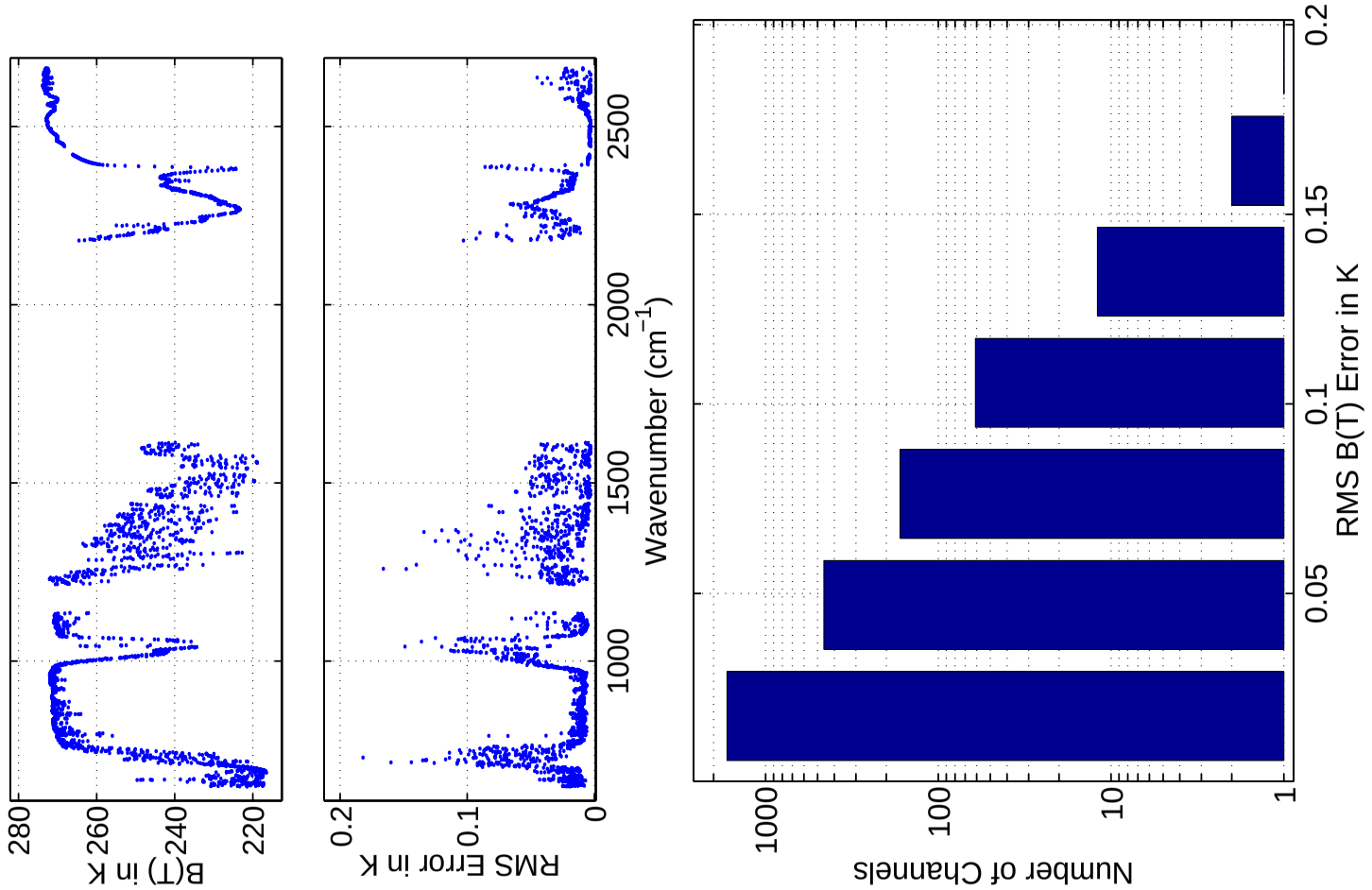
Overview

- AIRS-Project RTA vs Community Model RTA
- Timeline for providing updates to AIRS SRF's and RTA LBL data
- Initial checks on AIRS-RTA
- Closure needed between AIRS-RTA and Community Model?
- Comparison of ECMWF and NCEP model fields in AIRS B(T) "units"
- Comparison of ECMWF and NCEP model fields to aircraft observations during CLAMS. (More on Thursday.)

AIRS Fast Forward Model

- Hybrid PFAAST/OPTRAN algorithm
- No tangent linear/adjoint as yet
- Based on kCARTA (validated heavily with laboratory, ground, and aircraft observations)
- Water, ozone, methane, carbon monoxide can be varied
- Carbon dioxide column can be varied
- Fixed gas layer pathlength adjusted dynamically for water displacement in each RTA layer
- Reflected thermal component probably has the highest errors
- Available as a stand-alone package (SARTA). SARTA reads a simple HDF file (RTP format) with the profile (and radiances observations if desired) and outputs a RTP format HDF file with the observed radiance field filled in. F77/C/Matlab/IDL routines available to read/write RTP files.

AIRS-RTA Fitting Errors



AIRS-RTA Post-launch Timeline

- Provide accurate SRF's (updated channel centers) at Launch+3 months.
- Produce new AIRS-RTA (and SARTA) for these new channel centers one month after new SRF's are available. No new physics unless observe major problems. (May include channel spectra included if validated.)
- Launch+3 months to Launch+6 months validate AIRS-RTA and spectroscopy.
  - Depend on on JPL radiance calibration evaluation/fixes
  - Start with ECMWF model fields. Also build bias/std statistics from NCEP and CMC.
  - Over time include sonde bias/std and ARM CART sites
  - Maybe some upper water comparisons from NRA validation team
- UMBC needs to evaluate all bias/std statistics before making any possible changes to AIRS-RTA delivery at Launch+7
- Once the Level 2 retrieval is working we will examine residuals for all channels.

Community Model - as I understand it

- Presently based on layer-to-space transmittances computed at UMBC using kCARTA coupled with AIRS SRFs.
- Water and ozone can vary.
- Totally OPTRAN, with tangent linear/adjoint.
- Fitting accuracy?
- Note: present UKMO model uses UMBC computed layer-to-space transmittances, unsure what they will do in the future

Forward Models Used for AIRS Research

Organization	Spectroscopy	Parameterization
AIRS Project	kCARTA	PFAAST/OPTRAN hybrid
[1]DAO	kCARTA? (via NCEP?)	Optran/Comm. model
NCEP	kCARTA	Optran/Comm. model
ECMWF	GENLN2?/kCARTA?	SAF model-Gastropod?
UKMO	GENLN2?/kCARTA?	SAF model-Gastropod?
[2]CMC	GENLN2?/kCARTA?	SAF model/AIRS-RTA

[1] Only for radiance assimilation? Community model for retrievals as well?

[2] Plan to perform radiance monitoring with AIRS-RTA.

Closure with NWP RTA's?

- We all minimize (obs - calc) radiances. The forward model is as important as the observations.
- RTA has 3 major components, (1) Spectroscopy, (2) SRFs, and (3) parameterization.
- We need to work together to ensure that both NWP centers and the AIRS project are using the best of all 3 components, or equivalents that are simlar enough that assimilations/retrievals are not impacted.
- Will NCEP/DAO and ECMWF/UKMO need convolved layer-to-space transmittances from UMBC at Launch+3/4 months? If so, we need to come to an agreement on deliverables ASAP. This puts all parties on the same footing for spectroscopy and SRFs.
- How well do the AIRS-RTA and Community model parameterizations agree? Need an concerted effort to intercompare. Will be more difficult if NWP centers use a different LBL, or run our LBL on their own.
- *Bias correction* should be done with care. If biases can be traced to the physics, fix the forward model to the extent possible. For now biases must handle gross variations in CO_2?

Validation and Bias Correction

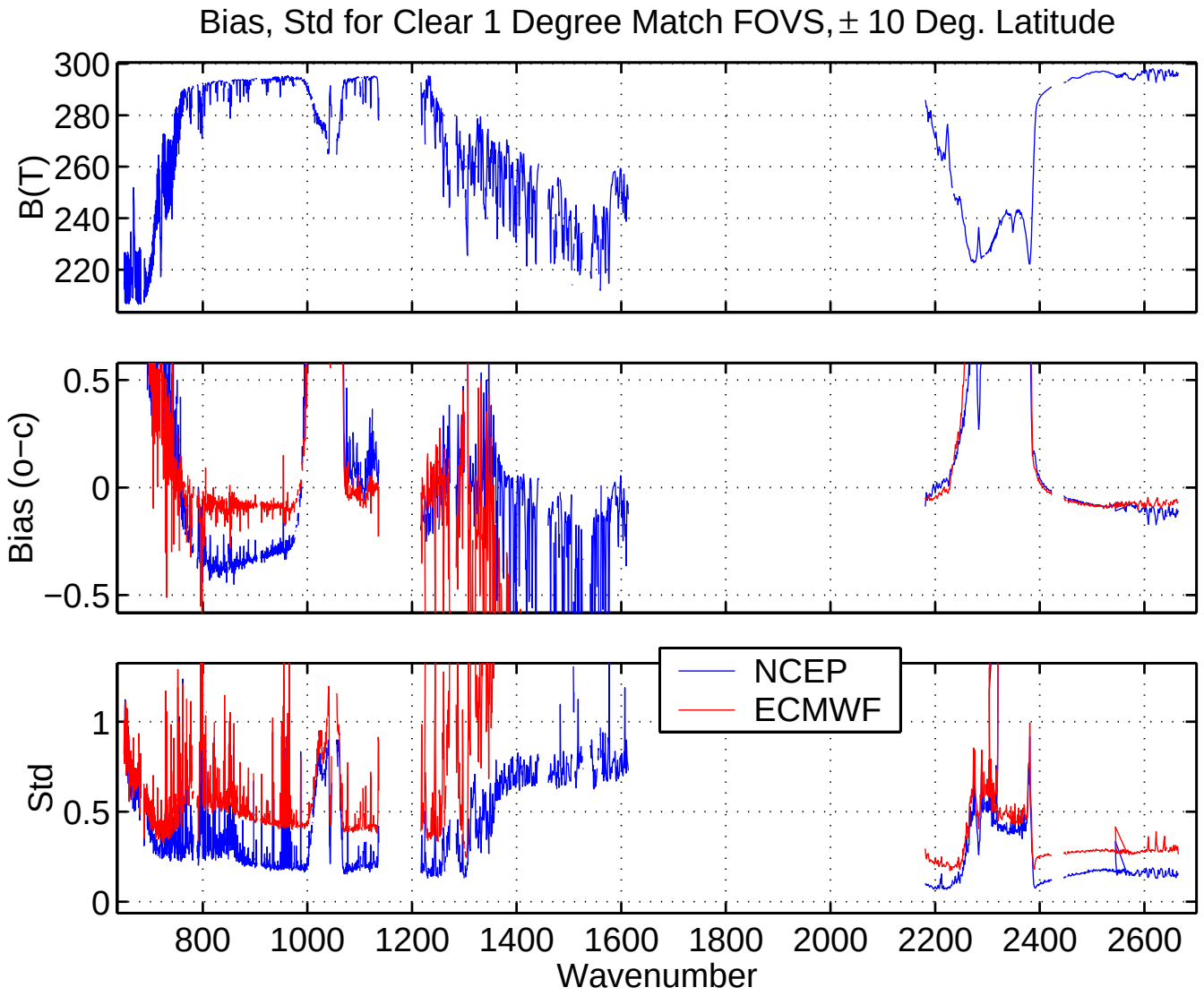
- We should connect AIRS project validation with independent validation at NWP centers. How will this take place? We can't look at graphs of 2378 channels.
- Key question for AIRS project retrievals: how to decide which channels should be bias corrected.
- Although NWP centers must drive biases to zero, can improved forward models also lower B(T) variances, leading to improved assimilation?
- Can 1D-var retrievals ultimately be used to determine the emissivity for bias monitoring/adjustment? Ditto for upper atmosphere state.
- Generally, how can we better model the surface in a way that is useful for operational retrievals.

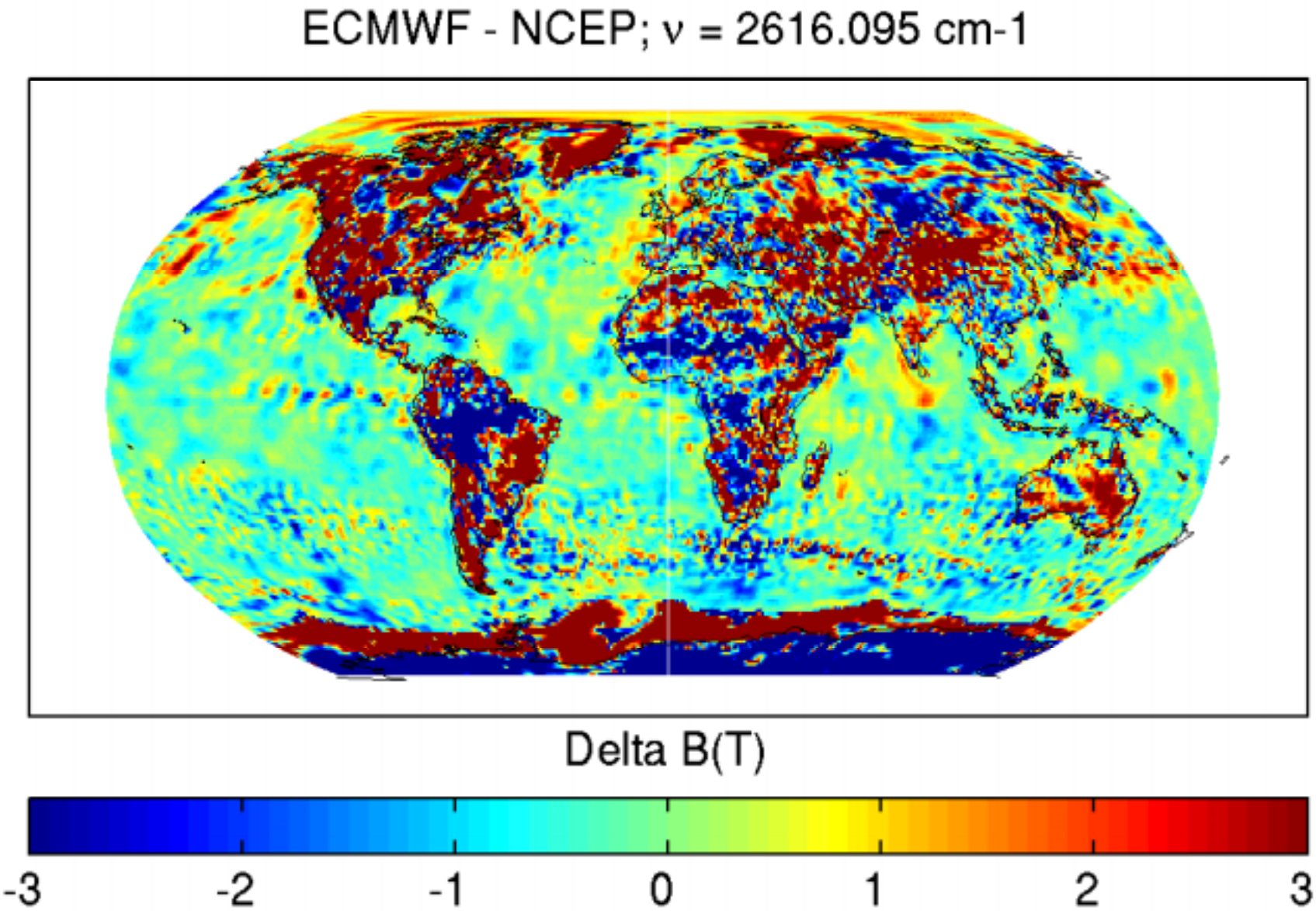
AIRS forward model improvements should appear at Launch+7 months, and hopefully the following year.

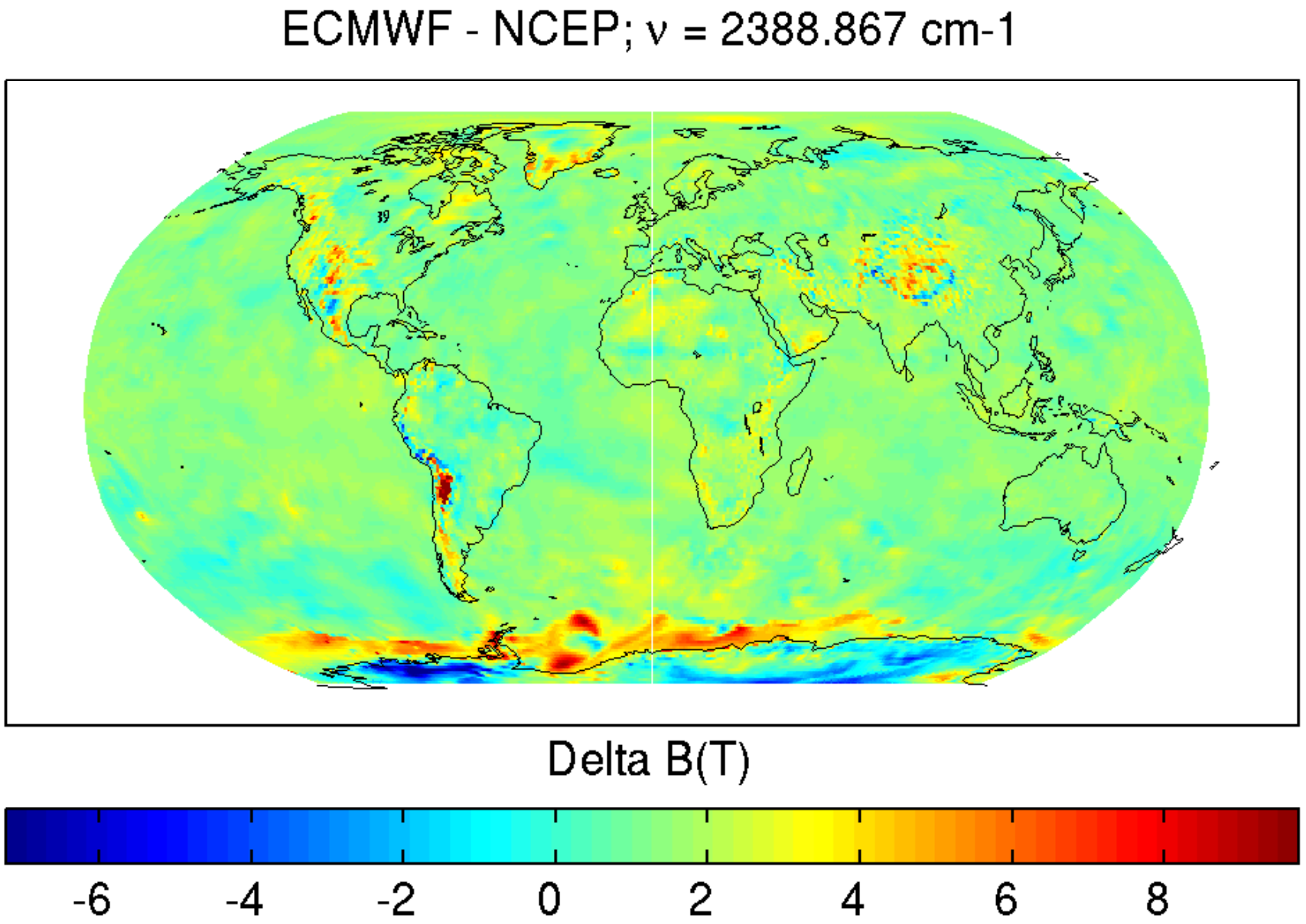
RTA Intercomparisons between AIRS NWP Centers

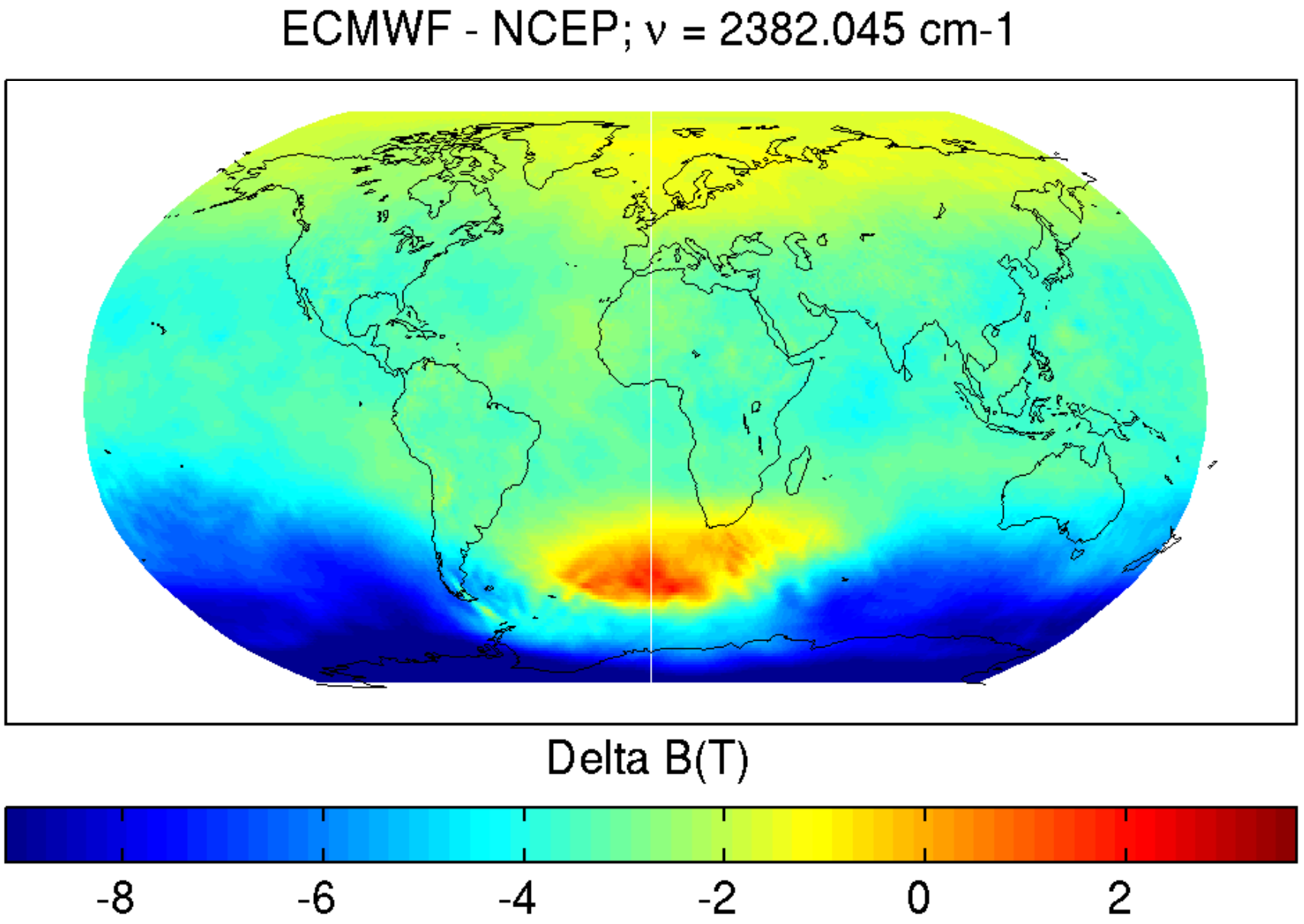
- How will we intercompare radiance bias/variance statistics among organizations using different forward models?
- Can we initially use a common, very conservative clear flag for these special test data sets?
- How will we communicate these clear flags and bias statistics?
- Do we, should we, have a universal FOV locater (UFL) for communication between groups? Lat/lon/time too difficult.
- How communicate radiances residual results between groups?
- Can NWP centers use *all the channels* for initial, but limited radiance residual monitoring? This would be very helpful for radiance and forward model validation.
- Can DAO supply their model to the AIRS project for offline bias monitoring?

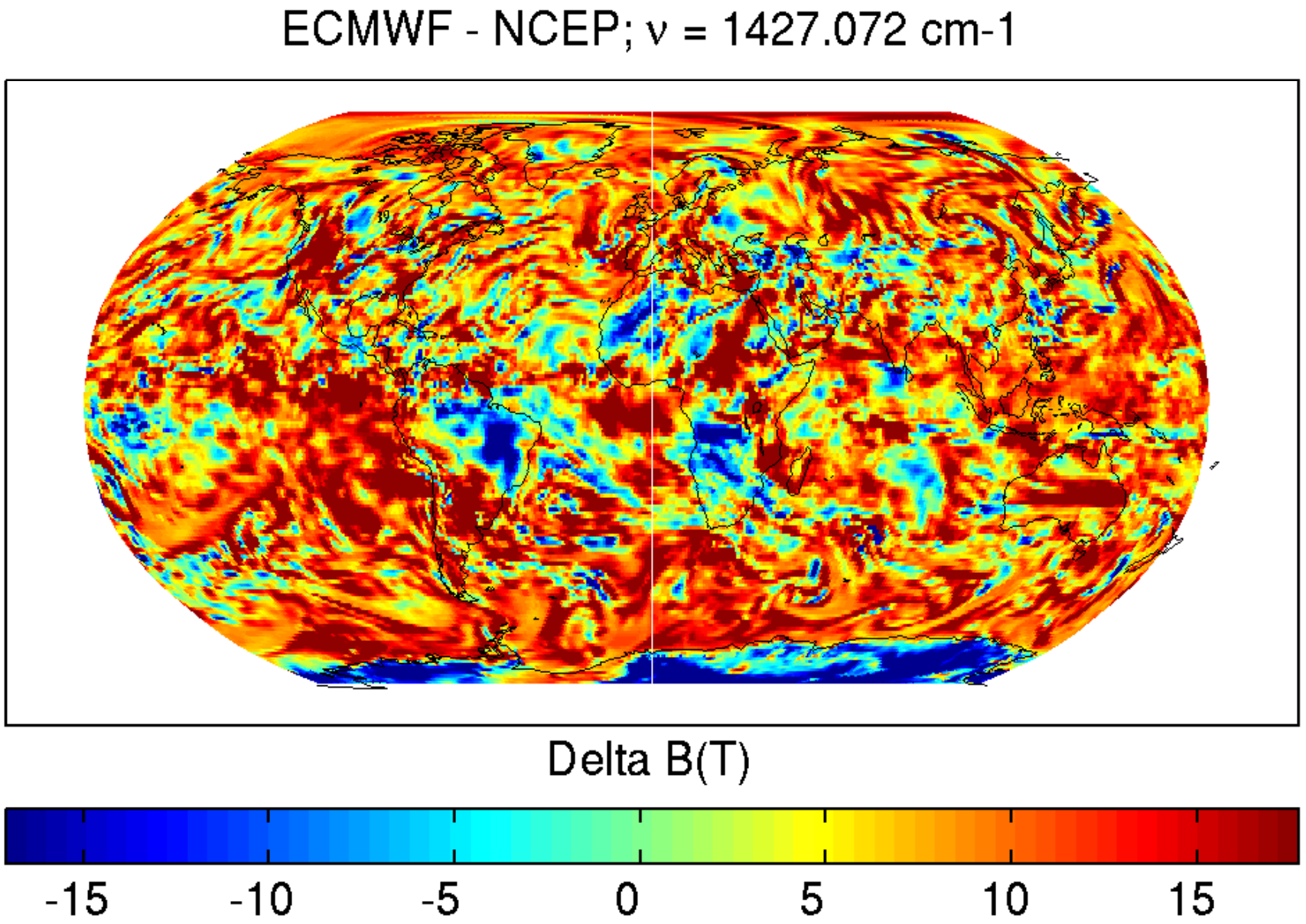
Use AIRS Matchup Files with NWP Model for Bias Examination

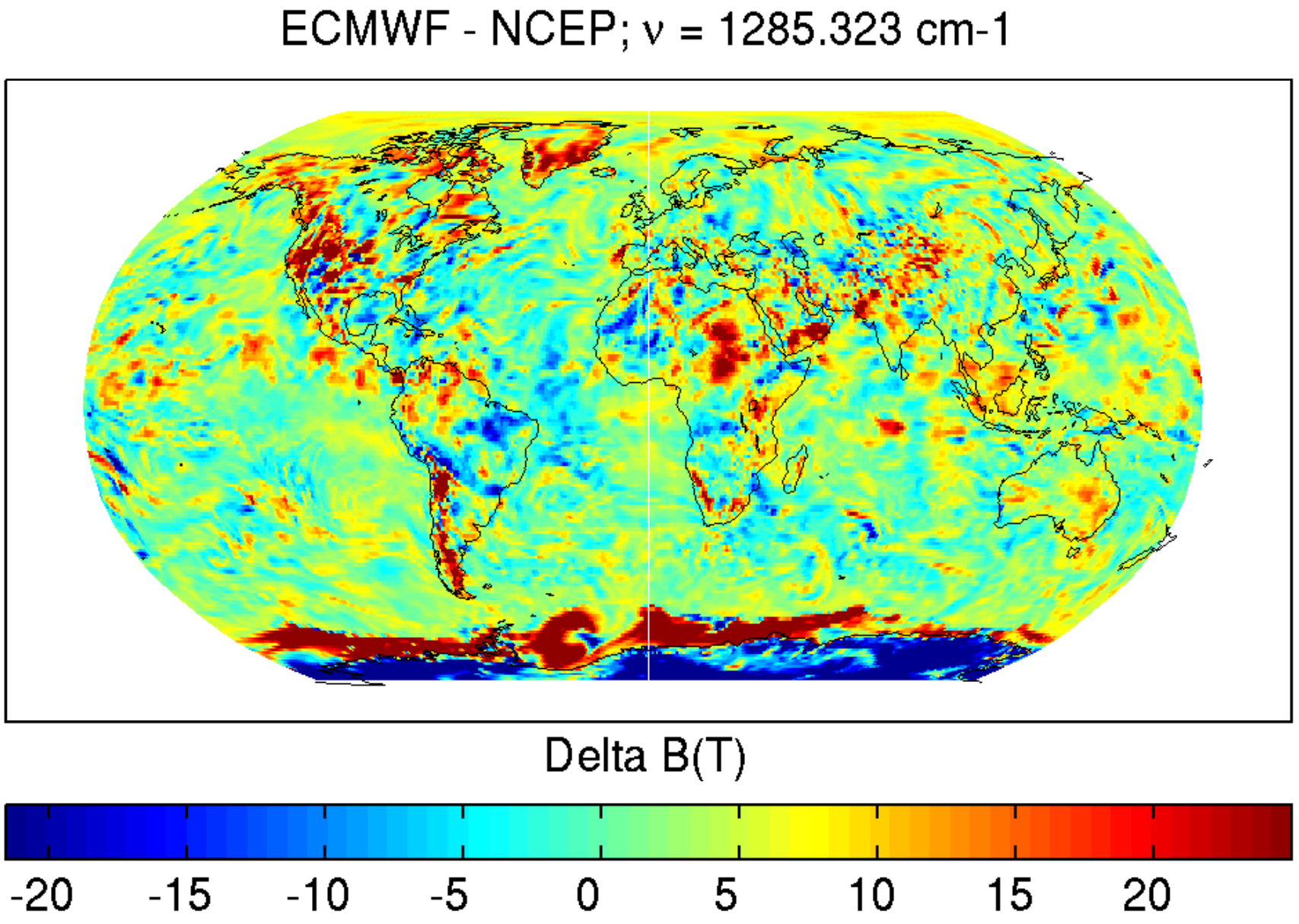


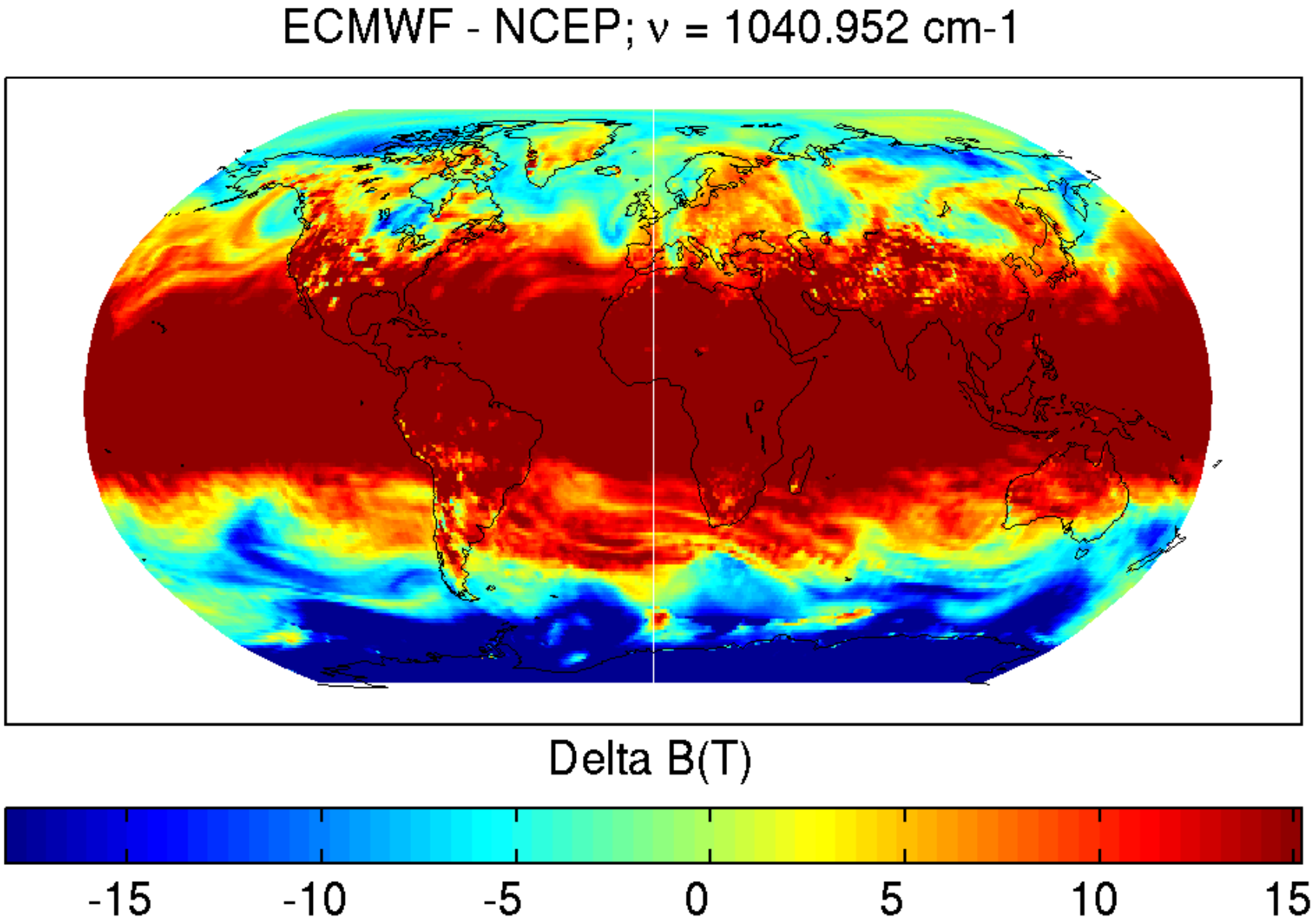

ECMWF - NCEP; ν = 2616.095 cm-1
Delta B(T)
-3
-2
-1
0
1
2
3

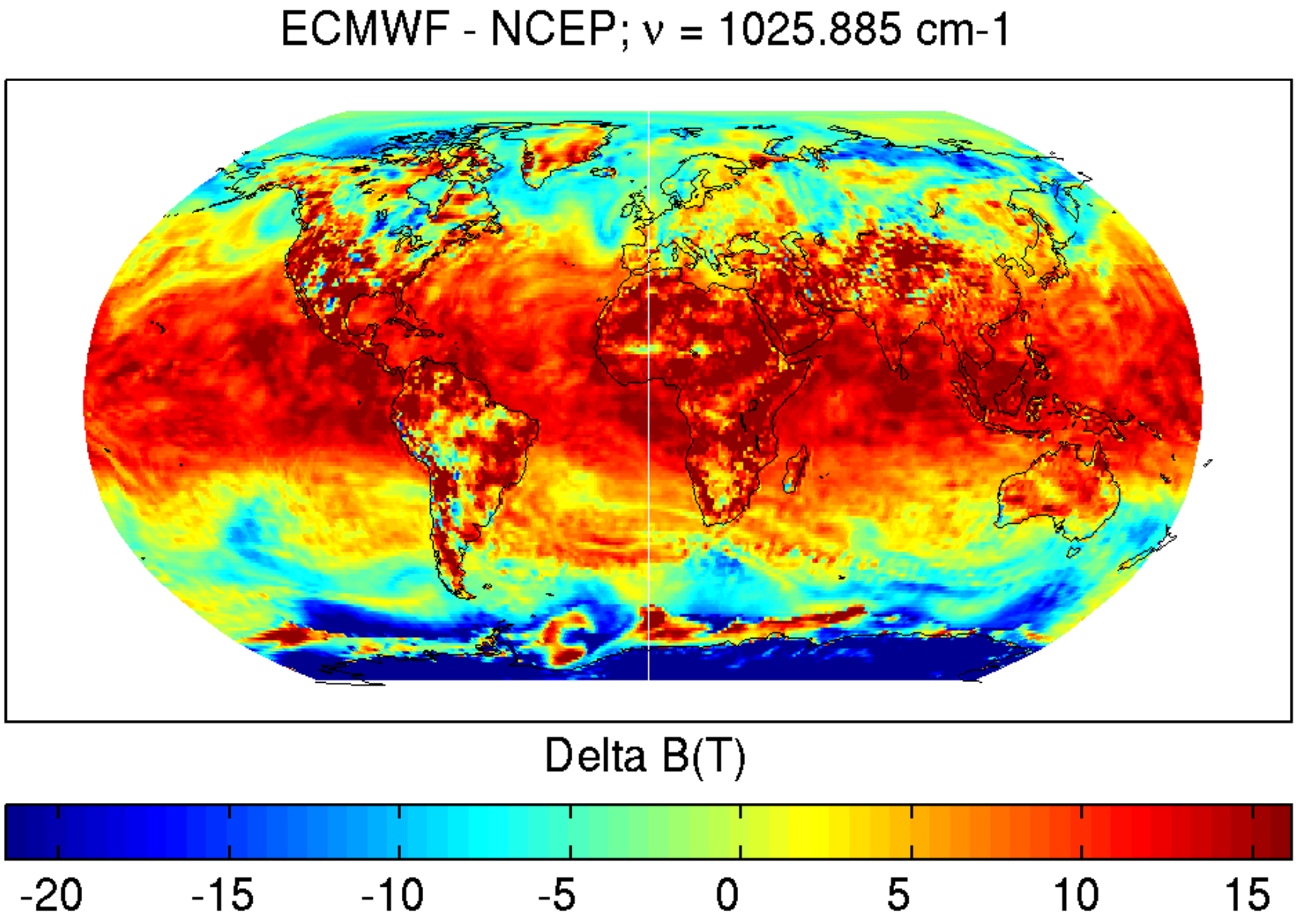

ECMWF - NCEP; ν = 2388.867 cm-1
Delta B(T)
-6
-4
-2
0
2
4
6
8

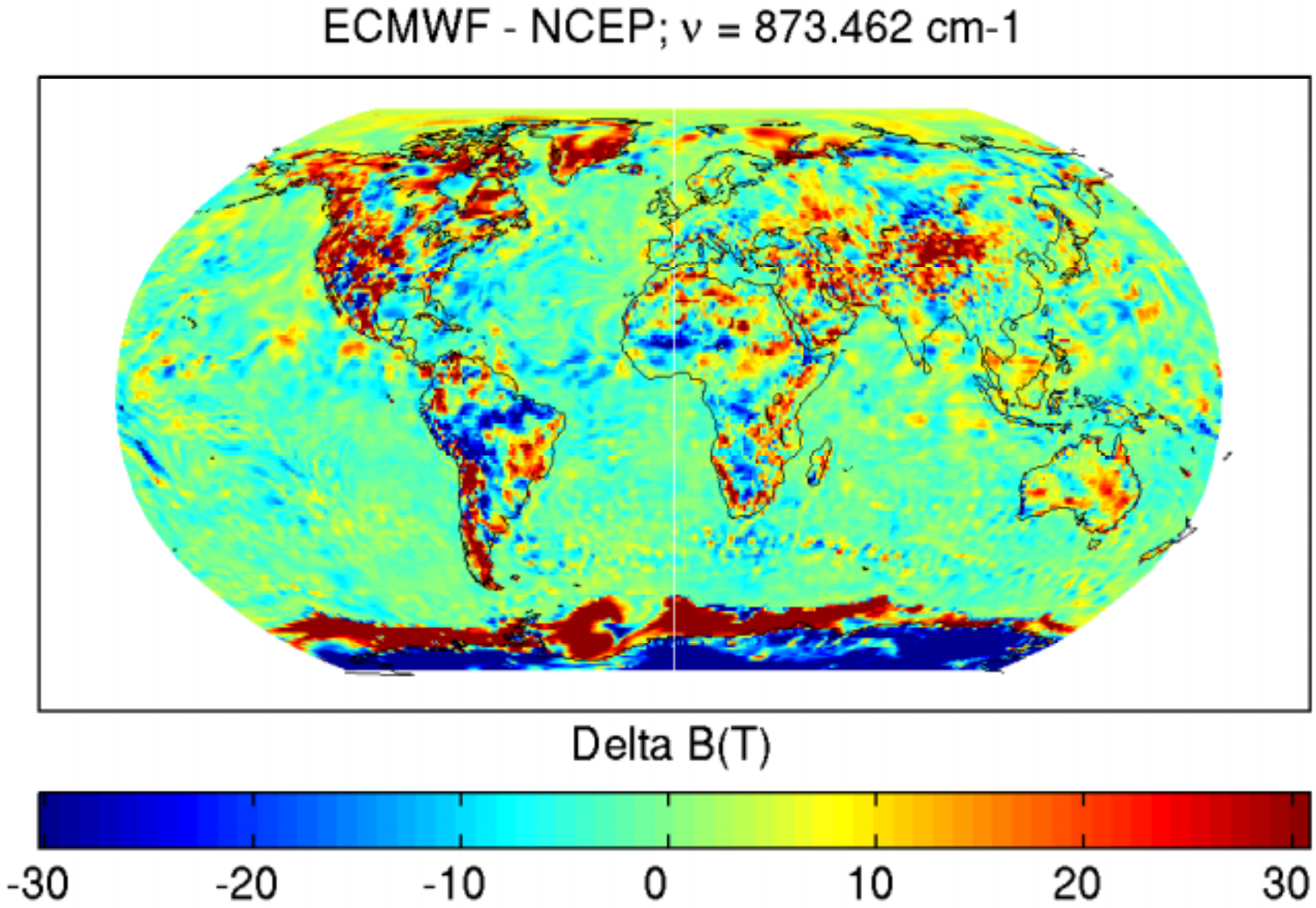

ECMWF - NCEP; ν = 2382.045 cm-1
Delta B(T)
-8
-6
-4
-2
0
2

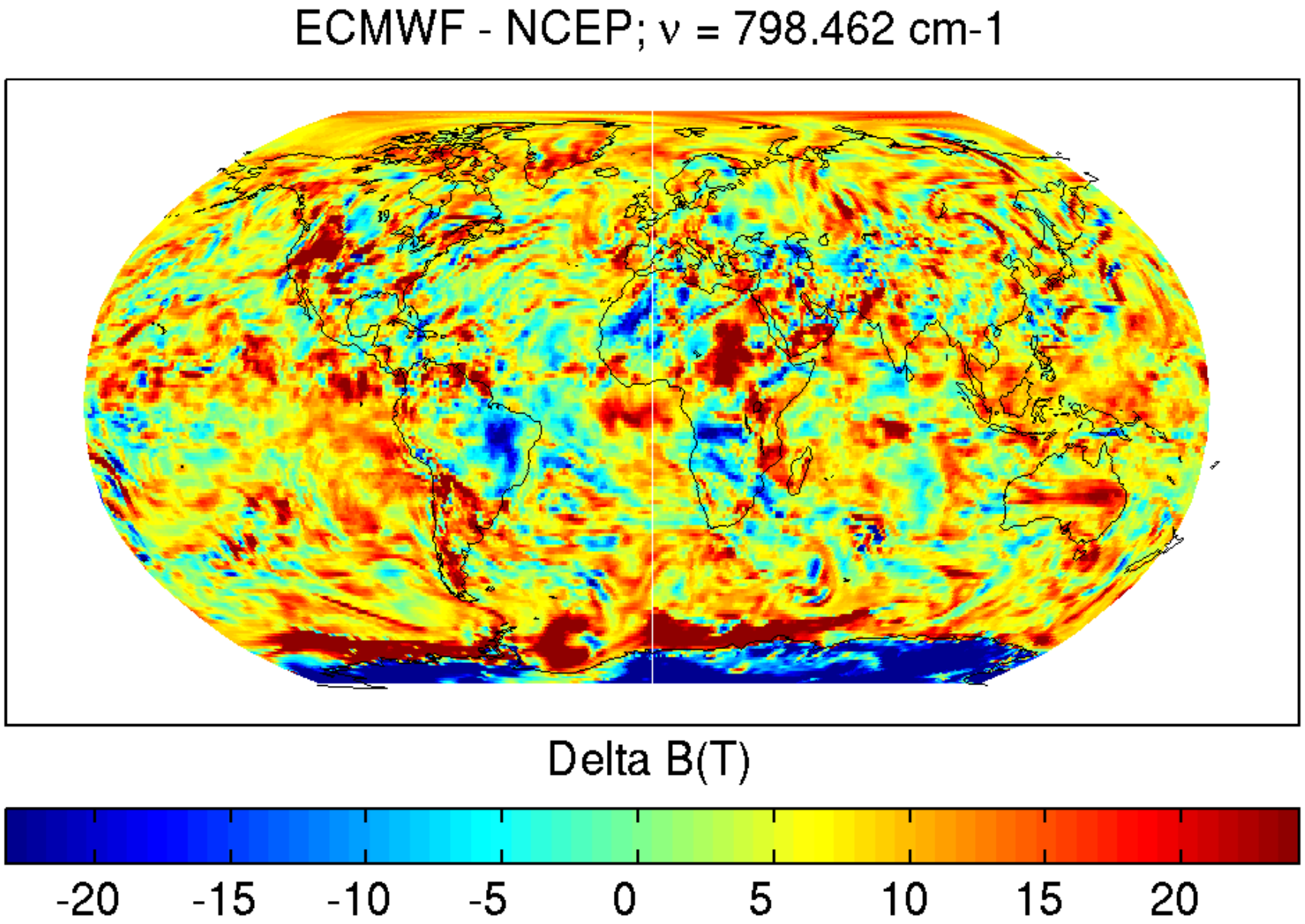

ECMWF - NCEP; ν = 1427.072 cm-1
Delta B(T)
-15
-10
-5
0
5
10
15

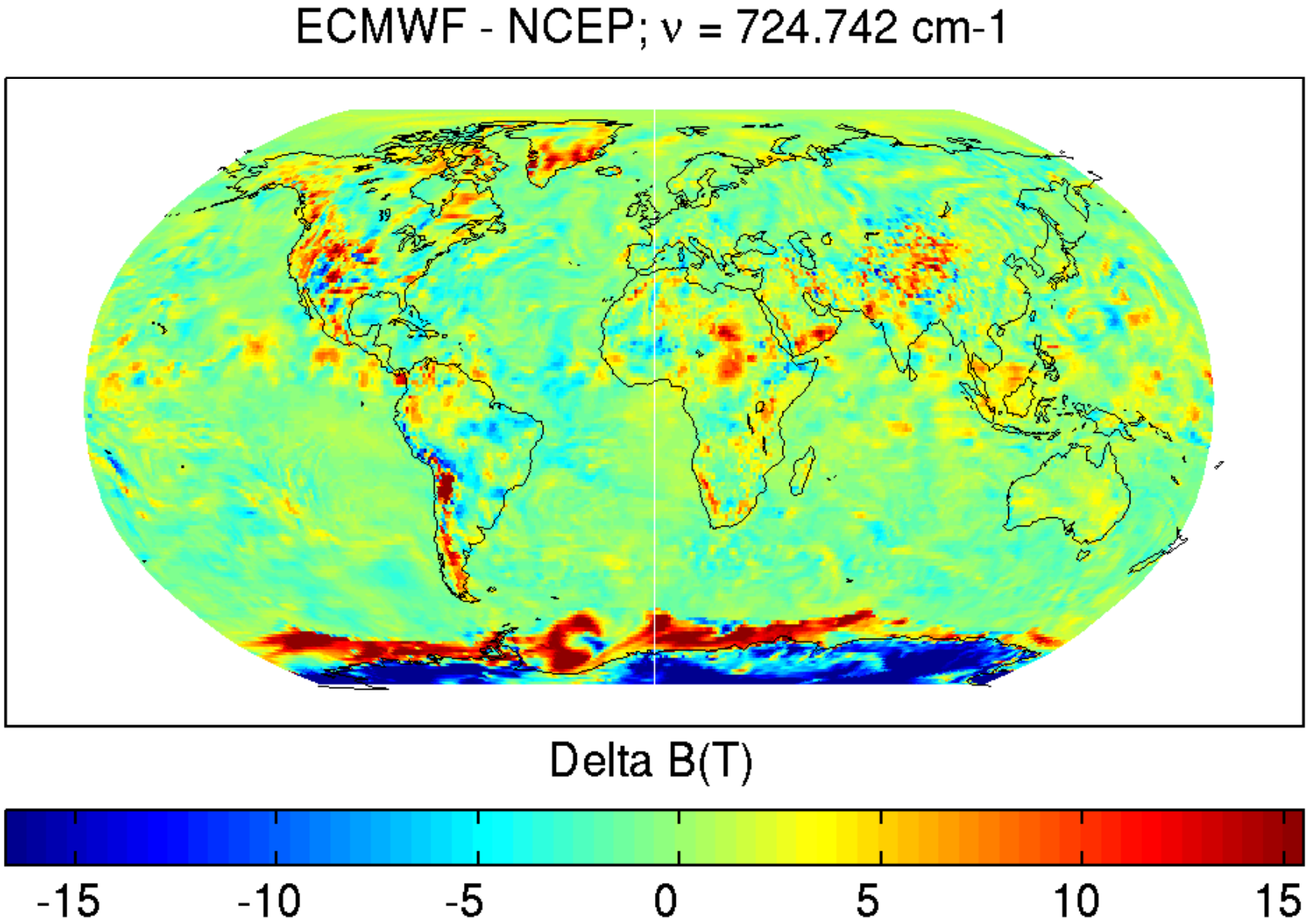

ECMWF - NCEP; ν = 1285.323 cm-1
Delta B(T)
-20
-15
-10
-5
0
5
10
15
20

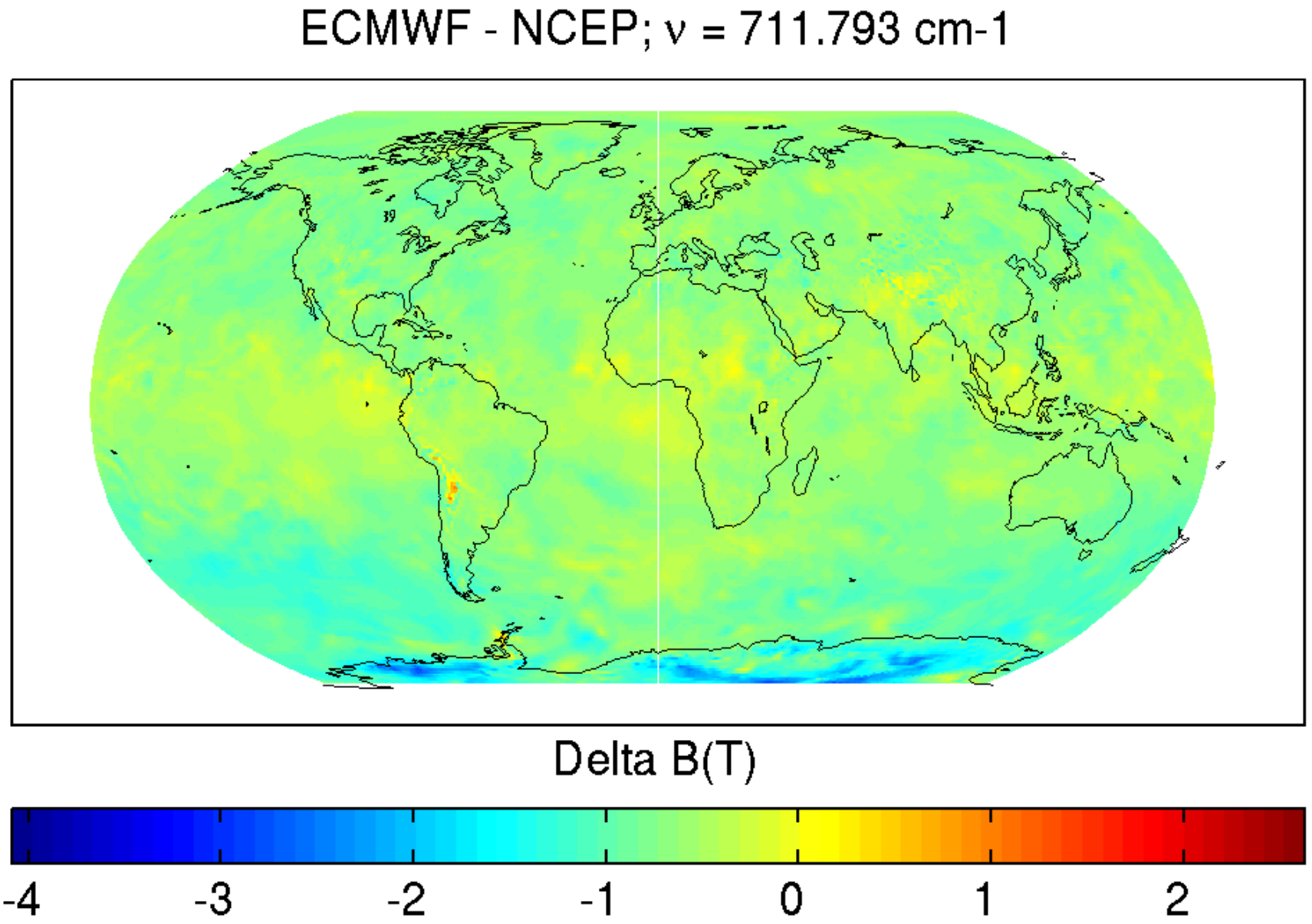

ECMWF - NCEP; ν = 1040.952 cm-1
Delta B(T)
-15
-10
-5
0
5
10
15

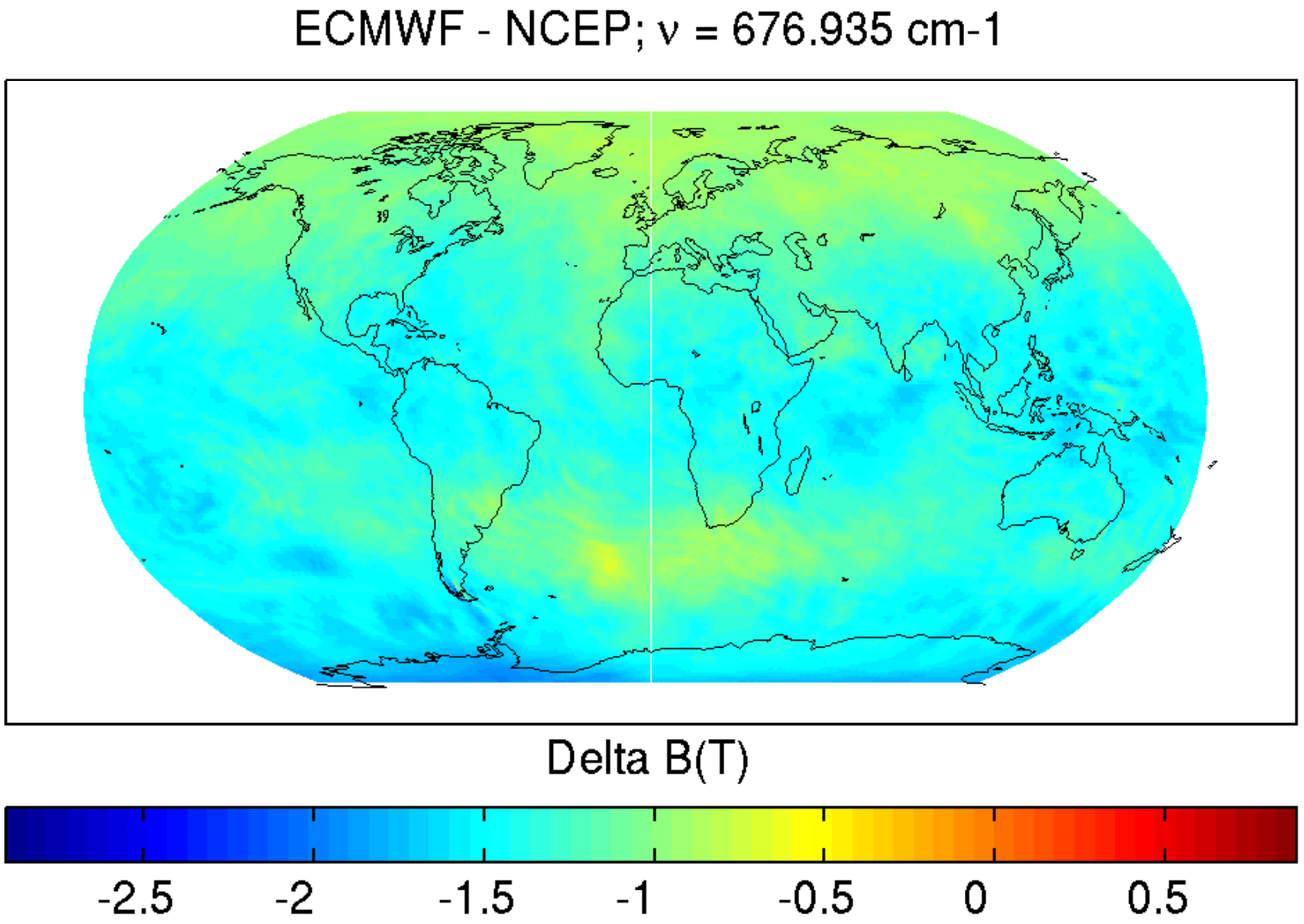

ECMWF - NCEP; ν = 1025.885 cm-1
Delta B(T)
-20
-15
-10
-5
0
5
10
15

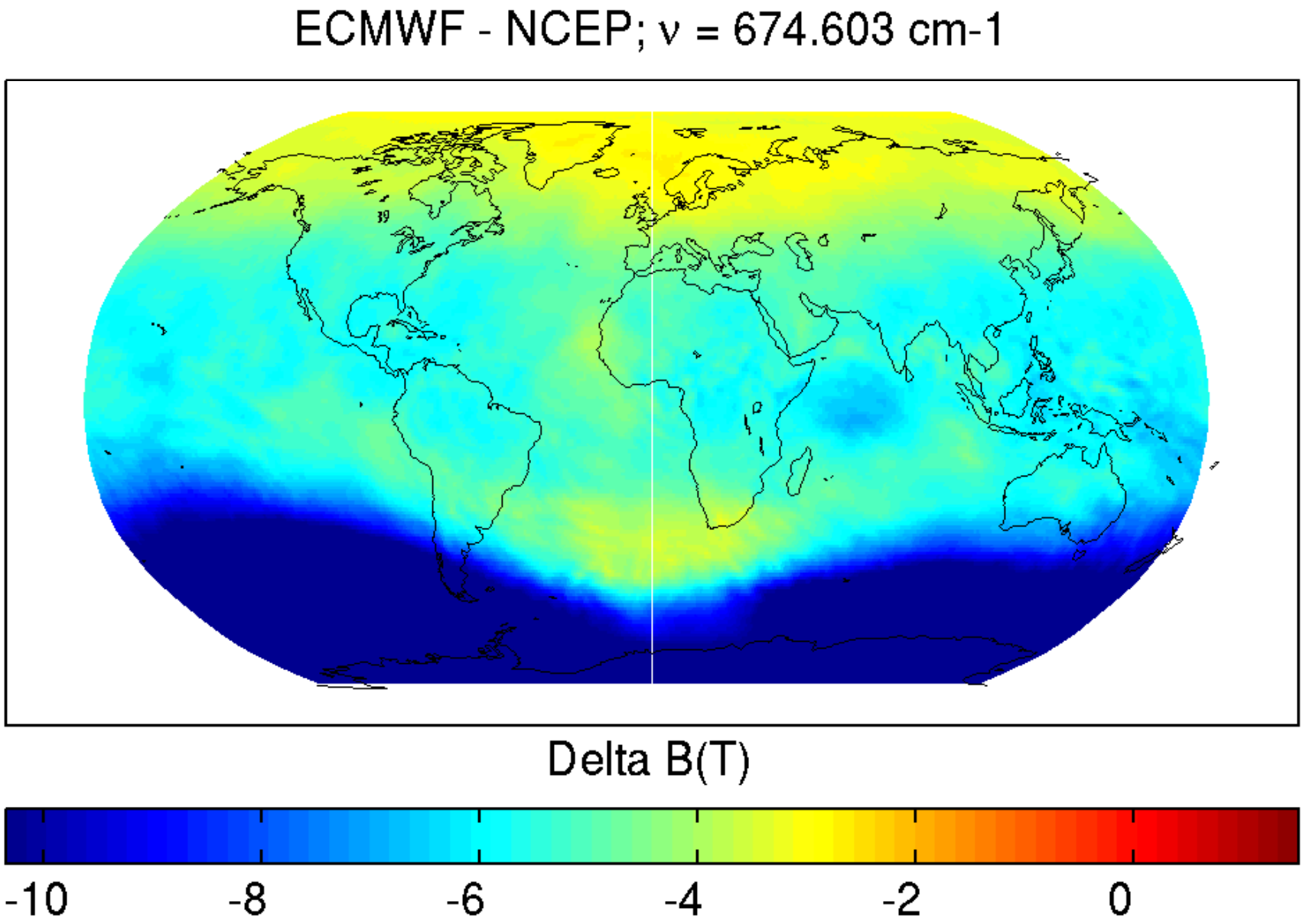

ECMWF - NCEP; ν = 873.462 cm-1
Delta B(T)
-30
-20
-10
0
10
20
30


ECMWF - NCEP; ν = 798.462 cm-1
Delta B(T)
-20
-15
-10
-5
0
5
10
15
20


ECMWF - NCEP; ν = 724.742 cm-1
Delta B(T)
-15
-10
-5
0
5
10
15


ECMWF - NCEP; ν = 711.793 cm-1
Delta B(T)
-4
-3
-2
-1
0
1
2


ECMWF - NCEP; ν = 676.935 cm-1
Delta B(T)
-2.5
-2
-1.5
-1
-0.5
0
0.5


ECMWF - NCEP; ν = 674.603 cm-1
Delta B(T)
-10
-8
-6
-4
-2
0